Ameren MISSOURI

Callaway Plant

February 2, 2015

ULNRC-06178

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

10 CFR 50.73

Ladies and Gentlemen:

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
LICENSEE EVENT REPORT 2014-006-00
MAIN GENERATOR EXCITATION TRANSFORMER FAULTED TO GROUND, CAUSING REACTOR TRIP

The enclosed licensee event report is submitted in accordance with 10CFR50.73(a)(2)(iv)(A) to report a reactor protection system actuation while critical and an auxiliary feedwater system actuation due to a plant trip caused by a ground fault in the main generator excitation transformer.

This letter does not contain new commitments.

Sincerely,

Barry Cox
Senior Director, Nuclear Operations

DRB/nls

Enclosure

cc: Mr. Marc L. Dapas
Regional Administrator
U. S. Nuclear Regulatory Commission
Region IV
1600 East Lamar Boulevard
Arlington, TX 76011-4511

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Fred Lyon
Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O-8B1
Washington, DC 20555-2738

Index and send hardcopy to QA File A160.0761

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APPROVED BY OMB: NO. 3150-0104 EXPIRES: 01/31/2017

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LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
Callaway Plant Unit 1	05000483	1 OF 4

4. TITLE

Main Generator Excitation Transformer Faulted to Ground, Causing Turbine and Reactor Trip

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
12	03	2014	2014	- 006 -	00	02	01	2015	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

100

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

FACILITY NAME	TELEPHONE NUMBER (Include Area Code)
T.B. Elwood, Supervising Engineer, Regulatory Affairs and Licensing	314-225-1905

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX
B	TL	EXC	Magnetic Technologies	Y					

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

At 00:22 hours on December 3, 2014, during normal power operations, A turbine and reactor trip occurred, when the main generator excitation transformer faulted to ground. The reactor trip was classified as "uncomplicated." Safety systems performed as designed. During recovery the valve providing flow from Motor Driven Auxiliary Feedwater Pump "B" to Steam Generator "D" failed to throttle closed afterwards. Repair of the excitation transformer was completed and the plant returned to power operations on December 6, 2014.

The construction of the excitation transformer includes high voltage jumper cables between termination points inside its protective enclosure and the winding taps of the transformer coils. These jumper cables are routed above the iron core of the transformer and are supported by insulating boards as well as restrained by nylon cable ties. The fault to ground was caused when a jumper cable dropped onto the iron transformer core after failure of the nylon cable ties. These cable ties were an original part of the transformer installed in 2007.

The root cause of the transformer failure was inadequate design (routing cables above the transformer core) and material selection (use of nylon cable ties) during the manufacture of the transformer.

1. DESCRIPTION OF STRUCTURE(S), SYSTEM(S) AND COMPONENT(S):

The Main Generator Excitation System Power Transformer, XMB01, [EIIS system TL] takes power at the 25-kV level and steps it down to the 880-Vac level for use in the static excitation system which provides a source of excitation to the rotating field in the Main Generator. Power is conducted to XMB01 by the Main Isophase Bus, which also carries the Main Generator output to the generator step-up transformers.

XMB01 is a dry transformer that was manufactured in 2006 by Magnetic Technologies Corporation and installed during the Callaway Plant Refuel 15 outage in the spring of 2007.

The construction of the transformer includes high voltage jumper cables between the termination points inside its protective enclosure (to which power is conducted from the 25-kV generator output isophase bus) and the winding taps of the transformer coils. These jumper cables are routed above the iron core of the transformer and situated on top of insulating boards which are slightly wider than the cable diameter. These in turn are supported by insulators. The cables were restrained by low-grade nylon cable ties that were subject to environmental degradation.

2. INITIAL PLANT CONDITIONS:

Prior to the event, the plant was in Mode 1, at 100% power. There were no activities going on at that time that could have caused this event. There was no equipment out of service that would have had an impact on this event.

3. EVENT DESCRIPTION:

At 00:22 on December 3, 2014, a turbine trip and reactor trip occurred. The "first out" alarm was 113F, "Unit Trip Turbine Trip". No other "first out" alarms were lit or should have been lit for conditions observed.

There were no activities going on at that time to cause the trip. The operating crew implemented the trip response procedures (E-0, "Reactor Trip or Safety Injection," and ES-0.1, "Reactor Trip Response") to verify the plant's response to the trip signal from 100% power.

The plant was stabilized in Mode 3 at 00:35.

Plant equipment was secured per the Emergency Operating Procedures. The Auxiliary Feedwater Actuation Signal was reset, and both Motor-Driven Auxiliary Feedwater Pumps were secured at 01:30.

The Feedwater Isolation Signal was reset, and the Feedwater Isolation Valves were re-opened. Feedwater supply was transferred from Auxiliary Feedwater to the Start-Up Feedwater Pump at 04:25.

It should be noted, however, that "D" Steam Generator level started rising following the trip, and valve ALHV0005 (Motor-Driven Auxiliary Feedwater Pump "B" to Steam Generator "D" Hand Valve) was identified as not throttling closed as expected. An operator was dispatched and closed the valve manually. Technical Specification (TS) 3.7.5 "Auxiliary Feedwater (AFW) System," Condition "C" was entered. The valve was repaired prior to the end of the 72-hour Completion Time.

4. ASSESSMENT OF SAFETY CONSEQUENCES:

The trip occurred without complications, and safety systems responded as required. Appropriate action was taken to restore the required flow to the "D" Steam Generator after the associated failure of ALHV0005 to throttle closed.

This event was evaluated with the Callaway PRA model. The evaluation determined the increase in core damage frequency of this event was less than 1E-6; therefore, this event was of very low risk significance. Use of the PRA model to evaluate the event provides for a comprehensive, quantitative assessment of the potential safety consequences and implications of the event, including consideration of alternative conditions beyond those analyzed in the FSAR.

5. REPORTING REQUIREMENTS:

This LER is submitted pursuant to 10 CFR 50.73(a)(2)(iv)(A) to report a reactor protection system actuation while critical and an auxiliary feedwater system actuation.

Specifically, 10 CFR 50.73(a)(2)(iv) states in part, "The licensee shall report:

(A) Any event or condition that resulted in manual or automatic actuation of any of the systems listed in paragraph (a)(2)(iv)(B) of this section…

(B) The systems to which the requirements of paragraph (a)(2)(iv)(A) of this section apply are:

(1) Reactor protection system (RPS) including: reactor scram or reactor trip. …

(6) PWR auxiliary or emergency feedwater system."

The RPS was actuated at 00:22 on December 3, 2014, during normal power operations (from 100% power). This fulfills the reporting requirement of 10 CFR 50.73(a)(2)(iv)(A) by actuation of the system specified in 10 CFR 50.73(a)(2)(iv)(B)(1).

A valid auxiliary feedwater system actuation was received as a direct consequence of the turbine and reactor trip. This also fulfills the reporting requirement of 10 CFR 50.73(a)(2)(iv)(A) by actuation of the system specified in 10 CFR 50.73(a)(2)(iv)(B)(6).

6. CAUSE OF THE EVENT:

The root cause of the transformer failure was inadequate design and material selection during the manufacture of the transformer.

The design was inadequate due to critical cables being routed precariously above the transformer core, and the material selected was inadequate because it relied upon low-grade nylon cable ties for restraint.

7. CORRECTIVE ACTIONS:

The corrective action to prevent recurrence is to add lacing to supplement the cable ties used to restrain the jumper cables inside the XMB01 transformer enclosure.

The root cause team determined that the use of lacing would prevent the jumper cable from dropping on the transformer core and causing an electrical short. The lacing would have a high temperature rating and would not require periodic replacement. Lacing is scheduled to be installed during the next refueling outage, planned for the spring of 2016.

It should be noted that as a remedial action, all nylon cable ties have been replaced with Tefzel cable ties which are designed for higher operating temperatures and a longer life expectancy.

8. PREVIOUS SIMILAR EVENTS:

No electrical plant events have occurred due to failed cable ties at Callaway. However, in 2003, severely embrittled and broken cable tie wraps were discovered in the diesel generator room. These tie wraps were on a power feed, but the cable was not displaced. Corrective actions included the use of heavy duty aqua-blue (Tefzel) safety-related cable ties.

Recent significant industry events include an age-related failure of plastic cable ties at Palo Verde Unit 1, which allowed a shield conductor to contact a 13.8kv bus. This resulted in catastrophic failure of a 480 volt AC load center as well as a reactor power cutback from 100% to 60% and declaration of an Unusual Event.